

**LIMNOPHYTON AUSTRALIENSE sp. nov. (ALISMATACEAE):  
A NEW GENERIC RECORD FOR AUSTRALIA**

by

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**ABSTRACT**

Aston, Helen I. *Limnophyton australiense* sp. nov. (Alismataceae): a new generic record for Australia. *Muelleria* 6(5): 311-316 (1987). — A new species of *Limnophyton* Miq., *L. australiense*, from Cape York Peninsula, Queensland, is described and illustrated and the characteristics and affinities of the genus are discussed. This is the first record of *Limnophyton* from Australia.

**DESCRIPTION**

***Limnophyton australiense* H. I. Aston, sp. nov.**

*Planta* aquatica, emergens, erecta, glabra. *Folia* basalia, longe petiolata. *Lamina folii* sagittata, 5-21 cm longa x 2.8-14 cm lata; lobo apici quam lobis basalibus parum longiore. *Caules* ad 100 cm alti x 2-10 mm diametro, simplices vel bifurcati (ad nodum infimum). *Verticilli inflorescentiae* 3-8 per caulem vel ramum caulis, quoque verticillo 3 bracteis praedito; verticillus infimus polygamus, usque ad 10 flores masculinos et 13 flores bisexuales ferens; verticilli alii solum masculini 9-12-flori. *Flores masculini* in pedicellis filiformibus (c. 9-14 mm longis x 0.15-0.5 mm diametro); sepala 3, concava, reflexa, c. 4.2-5 mm longa x 3.3-3.5 mm lata; petala 3, c. 6-6.3 mm longa x 3.7-4.4 mm lata; stamina 6 in verticillo uno regulari; filamenta c. 2 mm longa, tribus-quadrantibus inferioribus c. 1.1 mm latis, dialatatis, bulbosis; filamentorum bases tumidae, arcte appressae ad centrum floris; carpella absentia. *Flores bisexuales* ut in floribus masculinis sed carpellati atque pedicellis majoribus instructi; pedicelli fructiferi 25-60 mm longi x 1.5-3.5 mm diametro; receptaculum minutum, plus minusve planum vel perexigue elevatum; carpella 3-16, libera sessilia; ovarium c. 2 mm longum, porcula dorsali atque umbone in quoque latere munitum; stylus brevis crassus; stigma c. 0.4 mm longum x 1.4 mm latum, discoideum, cacumen styli cingens; ovulum singulare, basale, campylotropum. *Carpella fructificantia* 5-15, sessilia vel subsessilia, sicca, indehiscentia, endocarpium tenue, sclerenchymatum; exocarpium tenue, spongiosum. *Corpus carpelli fructificantis* plus minusve late oblongum vel late obovoideum, lateraliter compressum, sine cavernulis-aeris lateralibus magnis, c. 10-12 mm longum x 3.5-4 mm latum x 6.5-8 mm profundum (i.e. a margine dorsali usque ad marginem ventralem), porcatum, spinescens; porcae 3, una margines ventrales apicales et dorsales cingenti, quaque duarum aliarum depressionem lateralem plus minusve ellipticam non profundam cingenti; spinae porcae exorientes, 2-5 conspicuae pungentes 3-5 mm longae, porcis etiam spinas breviores (1-paucas) vel torulas usitate ferentibus. *Semen* perlate ellipsoideum, fortiter lateraliter compressum, c. 7 mm longum; embryo hippocrepicus.

*Limnophyton australiense* ob carpella fructificantia magna spinescentia facile distinguitur; forma carpellorum a speciebus omnibus aliis generis *Limnophyti* differt, praeterea cavernulae-aeriae laterales magnae desunt.

*Plant* aquatic, emergent, ? annual or perennial, glabrous. *Roots* fibrous, from a short rootstock to 1.5 cm long. *Stems* 2, basal, erect, to 100 cm high x 2-10 mm diam., simple or divided into two more or less equal branches at the lowest node; height from base to lowest node 46-71 cm; distal 19-29 cm of stem (or each branch) bearing 3-8 whorls of flowers, the internodes 1-8 cm long and somewhat longitudinally ribbed. *Leaves* several, basal, petiolate, erect. *Petiole* 40-81 cm long x 2-10 mm diam., sheathed at the base, (producing a milky exudate when broken, *Hyland 6296*); sheath 23-42 cm long, gradually tapered above. *Leaf lamina* thin-textured, membranous, sagittate, slightly to strongly constricted just above the level of insertion of the petiole, 5-21 cm long x 2.8-14 cm wide, with the greatest width usually across the proximal to mid-portions of the basal lobes; apical lobe slightly longer than the basal lobes, 2.8-11 cm long x 2.2-12 cm wide; basal lobes somewhat incurved with a sinus of (40°-55°-75° angle (the angle formed at the petiole insertion by lines connecting that point to the tips of the basal lobes), each 2.3-10 cm long

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x 0.9-5.5 cm wide; main lamina nerves conspicuous, c. 11-20, more or less longitudinal-curved, radiating from the point of petiole attachment along the apical and basal lobes; crossnerves more or less inconspicuous, (1-)1.5-4 mm apart, at 60°-80° angle to the main nerves. *Inflorescence whorls* 3-8 per stem or stem-branch, the lowest 1(-2) whorls polygamous, the remaining whorls male only. *Polygamous whorl* with 3 bracts and up to 10 male and 13 bisexual flowers; bracts membranous, lanceolate, acute, c. 30 mm long x 9 mm wide, with c. 9 main and many finer longitudinal nerves; each bract subtending 1-4 male and 1-5 bisexual flowers. *Male whorls* with 3 bracts and 9-12 male flowers; bracts similar to those of the polygamous whorl but smaller, to c. 20 mm long x 9.5 mm wide, each bract subtending 3-4 male flowers. *Male flowers* on filamentous pedicels c. 9-14 mm long x 0.4-0.5 mm diam. in the polygamous whorl, only 0.15-0.25 mm diam. in male whorls; sepals 3, more or less round or broadly ovate, very concave to almost hooded, c. 4.2-5 mm long x 3.3-3.5 mm wide, reflexed; petals 3, alternate with the sepals, broadly ovate to lanceolate-oblong, obtuse, contracted at the base, c. 6-6.3 mm long x 3.7-4.4 mm wide, more or less uncurved to spreading; stamens 6, in one regular whorl, 2 opposite each sepal; filaments c. 2 mm long, slender above, the lower three-quarters dilated into a conspicuous, bulbous, more or less papillose-surfaced base c. 1.1 mm wide; swollen filament bases tightly appressed at the flower centre, forming a 6-partite filament mass  $\pm$  3 mm diam.; anther broadly ovate to broadly obloid, dorso-ventrally compressed, c. 1.5-1.7 mm long x c. 1.2-1.4 mm wide x c. 0.5-0.6 mm deep, 2-loculed with broad connective tissue between the locules, basally attached, dehiscing laterally, maroon-brown; carpels absent. *Bisexual flowers* as for the male flowers but larger pedicelled and carpellate; pedicels 25-60 mm long x 1.5-3.5 mm diam. when in fruit; receptacle minute, very slightly raised, more or less flat; carpels irregularly centrally placed on the receptacle, the stamens being separated and peripheral; carpels 3-16, free, sessile, c. 3 mm long; ovary c. 2 mm long, somewhat laterally compressed, with a dorsal ridge and with a large lateral boss on each side, the ridge bearing 1-4 low blunt points and each boss bearing from its edges 1-3 similar points; style short and thick, c. 0.6 mm long, placed apically at the ventral edge of the ovary, persistent; stigma c. 0.4 mm long x c. 1.4 mm wide, an undulate, slightly crenate to lobed, more or less horizontal flange encircling the style summit, narrowed and slit on the ventral edge, densely papillate with minute papillae; ovule 1, basal, compressed-ellipsoid, campylotropous. *Fruiting carpels* 5-15, sessile or sub-sessile on short thick gynophores to c. 3 mm long, dry, indehiscent, with thin schlerenchymatous endocarp and thin spongy exocarp; body of fruiting carpel more or less broadly oblong or broadly obovoid, laterally compressed, without large lateral air chambers, c. 10-13 mm long (including gynophore) x 3.5-4 mm wide x 6.5-8 mm deep (= dorsal to ventral edge), ornamented with thin low ridges and with 2-5 conspicuous pungent spines 3-5 mm long, usually also 1-few smaller spines or low projections; ridges 3, one encircling the ventral apical and dorsal edges, the other two encircling two shallow and more or less elliptical depressions sited one on each lateral face; spines and projections positioned on the ridges. *Seed* 1, basal, very broadly ellipsoid, strongly laterally compressed, c. 7 mm long x 2.5 mm wide x 5-6 mm deep; embryo horseshoe shaped.

#### TYPE COLLECTION:

38 km from Wakooka on the track to Bathurst Bay and Cape Melville National Park, 14° 1'- S., 144° 2'- E., Cook district, Queensland, 19.vi.1984, *J. R. Clarkson* 5434 (Holotype: BRI. Isotypes: BRI (one large leaf), K, MEL 1545207, QRS; also spirit collections BRI, MEL 1265/B).

#### OTHER SPECIMENS EXAMINED:

*Queensland (Cape York Peninsula)* — Bathurst Bay (Muck River), 14° 15' S., 144° 25' E., 27.vii.1972, *B. Hyland* 6296 (QRS 042718 and 042719); "Lakefield", c. 12 km NNW. of "Breeza Plains" outstation, c. 14° 44' S., 144° 05' E., 10. viii. 1978, *A. Kanis* 1962 (BRI 293616; CANB 326124; also L n.v.); 30 km N. of "Kalpowar" homestead, 14° 34' S., 144° 10' E., 13.viii.1978, *K. Pajmans* 2887 (CANB 286881-883).

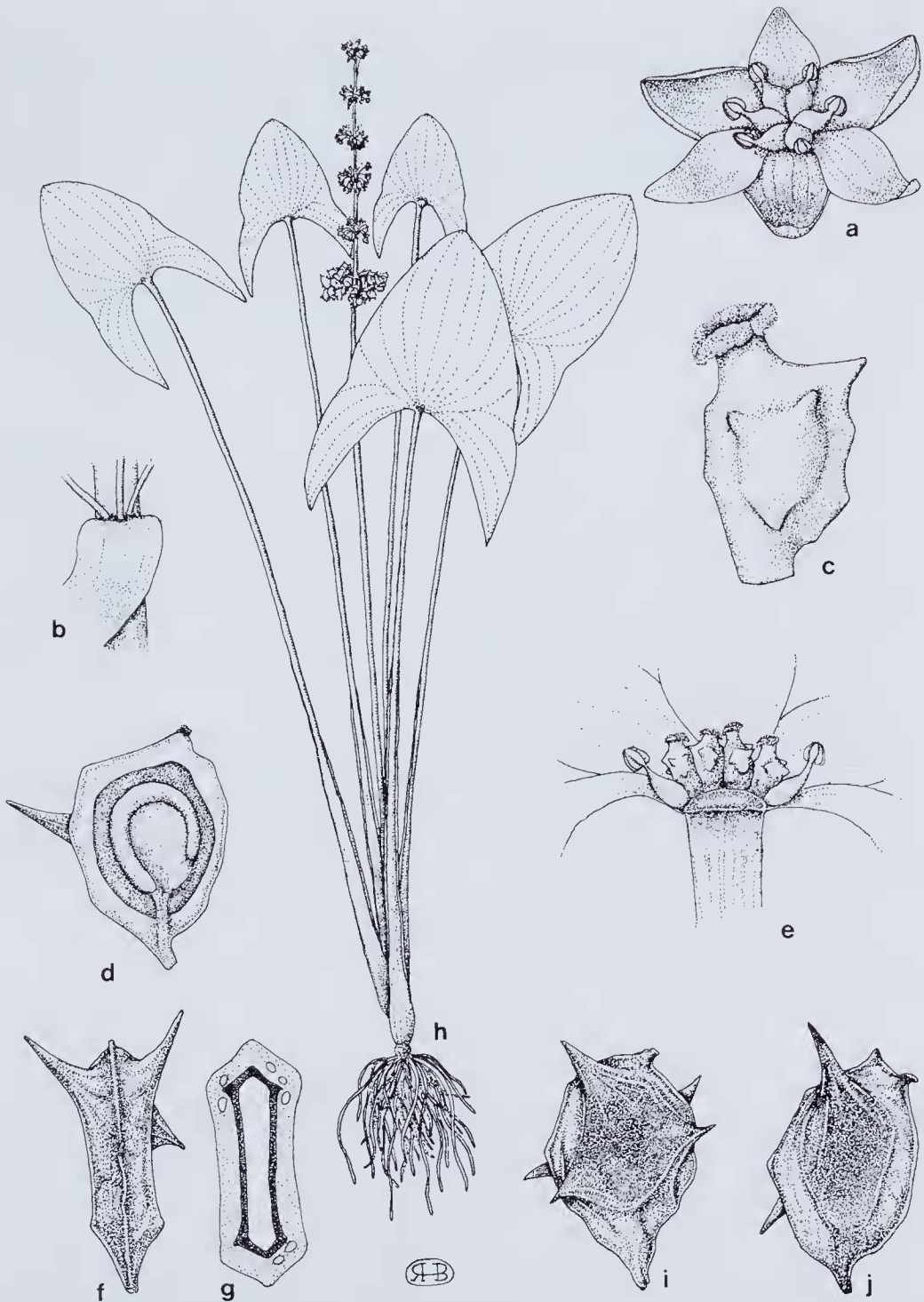


Fig. 1. *Limnophyton australiense*. a — male flower, x 3. b — portion of male whorl, showing three pedicels arising from the axil of one of the bracts, x 3. c — carpel from bisexual flower, x 15. d — fruiting carpel, L.S. showing the solitary seed with curved embryo; carpel cavity darkly stippled, x 3. e — bisexual flower, L.S. showing the slightly raised receptacle, x 4. f — fruiting carpel, dorsal view, x 3. g — fruiting carpel, T.S. showing the sclerenchymatous endocarp (dark) and very small air cavities within the spongy exocarp; seed removed, x 4. h — habit, x 0.2. i — and j — fruiting carpels, lateral views showing varied development of spines, x 3. All from Clarkson 5434.

## DISTRIBUTION:

*Queensland (Cape York Peninsula)* — In the Bathurst Bay and Lakefield regions. Known only from the four collections cited above and from 11 km NNW. of the crossing of the Kennedy River between "Laura" and "Lakefield" homesteads, c. 14° 59' S., 144° 15' E., Lakefield National Park, located by S. Trezise, 15.v.1982. There is no preserved collection from the Lakefield site but I have seen one large typical leaf from there and consider this unmistakable compared with that of any other naturally occurring species in Australia.

## HABITAT:

Forms dense stands in shallow fresh water of lagoons and waterholes in lowland areas. Water depth of 30 cm and altitudes of 5 and 50 metres recorded. ". . . waterhole in *Eucalyptus polycarpa* woodland" (*Clarkson 5434*). "Shallow billabong surrounded by *Melaleuca*" (*Kanis 1962*). ". . . shallow water with muddy bottom" (*Hyland 6296*).

## NOTES:

*Limnophyton australiense* is distinguished by its large spinescent fruiting carpels. These are shaped unlike those of any other species of *Limnophyton* and lack large lateral air chambers.

Large lateral air chambers are conspicuous in the fruiting carpels of the type species, *Limnophyton obtusifolium* (L.) Miq., and are usually regarded as a generic character. To determine if such chambers were actually present in *L. australiense* but had deflated upon drying two fruiting carpels were boiled in water for softening and expansion. Sectioning of the boiled carpels showed that they more or less retained their dried shapes and that the only air chambers were minute and discontinuous, occurring irregularly throughout the exocarp in the vicinity of the lateral ridges, particular near the spine bases.

The depression and encircling ridge present on each side of the fruiting carpel are developed from the lateral boss of the immature carpel.

*Clarkson 5434* records flowers [? = sepals and petals] yellow, bracts reddish. *Kanis 1962* records tepals green.

Measurements of vegetative parts and fruiting carpels have been taken from dried specimens, whereas floral measurements and most descriptions of floral parts have been made from spirit material.

The epithet *australiense* is bestowed because this species is the only one of its genus known from Australia, where apparently it is endemic.

## CHARACTERISTICS AND AFFINITIES OF LIMNOPHYTON

*Limnophyton* Miq., Fl. Ned. Ind. 3:242 (1856, non 1855), is found in tropical Africa, Madagascar, India, Ceylon, Vietnam, Java, Timor (Hartog, 1957) and, from the current recording, in north-east Australia. Apart from *L. australiense*, three other species are recognised in the genus, all of which are treated in detail by Symoens (1984).

Pichon (1946) accepted 15 genera within the tribe Alismateae, his equivalent of the family Alismataceae as generally circumscribed today. More recent authors such as Hutchinson (1973), Cook *et al.* (1974) and Cook (1978) accept only 11 to 13 genera within the family, with Cook commenting that "generic delimitation in the Alismataceae is somewhat unsatisfactory". *Limnophyton*, however, is readily distinguished from all other genera except *Sagittaria* L. (including *Lophotocarpus* T. Durand) by its polygamy. In other characters *Sagittaria* is quite distinct, having numerous carpels arranged spirally on a large globular to oblong receptacle, the number of stamens indefinite (7-numerous) and the flowers chiefly unisexual with the upper male and the lower female or occasionally bisexual.

Hartog (1957), Symoens & Billiet (1975), Symoens (1984) and Carter (1960) give detailed treatments of *Limnophyton* from Malesia, Africa, Africa and Africa respectively. The first three papers and Cook *et al.* (1974) give the presence of large lateral air chambers in the fruiting carpels as one of the main characters segregating *Limnophyton* from *Caldesia* Parl., which lacks air chambers. Hutchinson (1973) ignored this character. As the newly described species lacks large carpel air chambers (see notes above under description) it seems that their presence or absence is significant only at specific, rather than generic, level. In other characters the new species is readily placed in *Limnophyton*. Although *Caldesia* is still somewhat poorly defined and in some cases shows "extreme intrageneric variation" (Lai, 1977) or is "somewhat artificially segregated" (Cook, 1978) its tendencies lie toward the bisexual-flowered, large-receptacled, 9-many stamened, New World genus *Echinodorus* Engelm. and its allies (Cook *et al.*, 1974) rather than toward the Old World genus *Limnophyton*.

*Caldesia* occurs in northern and north-eastern Australia (Aston, 1973) as well as in Europe, Africa, Madagascar, south and east Asia, Malaysia and New Guinea (Hartog, 1957; Symoens, 1984; Leach and Osborne, 1985). Its major similarities with and distinctions from *Limnophyton* are shown in the following key:

- Leaves basal; receptacle small, more or less flattened; carpels 2-20, free, crowded, not spiralled or whorled; ovules 1 per carpel; fruiting carpels dry and indehiscent.....1
1. Inflorescence usually simple, with flowers in whorls of more than three; flowers polygamous; stamens 6; filaments prominently dilated at the base; style thickish with expanded flanged apical stigma; fruiting carpels with or without large lateral air chambers.....*Limnophyton*
  1. Inflorescence usually a compound pyramidal panicle, the branches and flowers usually in whorls of three; flowers bisexual; stamens 6(-12); filaments filiform or flattened, not dilated; style slender, distally stigmatic, not expanded; fruiting carpels without large lateral air chambers.....*Caldesia*

Additionally, for the species found in Australia, the leaf laminas of *Limnophyton* are sagittate whereas those of *Caldesia* are cordate, or more or less cordate but with the basal lobes obtusely to acutely pointed. This distinction also applies to extra-Australian species except *Limnophyton fluitans* Graebner with linear-lanceolate laminas (Symoens, 1984) and *Caldesia grandis* Samuelsson with the lamina base either cordate or broadly obtuse to truncate (Lai, 1977).

#### ACKNOWLEDGEMENTS

My gratitude is extended to Mr S. Trezise of Laura, Queensland, whose 1982 discovery of the Lakefield population first alerted me to the presence of some unknown alismataceous species in the area; to Mr J.R. Clarkson, Mareeba branch of the Queensland Herbarium, whose dried and spirit material from the type population enabled the species to be adequately described; to the Queensland Herbarium, Brisbane, the Australian National Herbarium, Canberra, and Mr B.P.M. Hyland of C.S.I.R.O. Forest Research Institute, Atherton, Queensland, for the loan of or access to additional collections; to Dr J.H. Willis, Brighton, Victoria, for preparation of the Latin description from an English draft; to Mr R.H. Barley, National Herbarium of Victoria, for providing the illustration.

#### REFERENCES

- Aston, H. I. (1973). 'Aquatic Plants of Australia'. (Melbourne University Press: Melbourne).
- Carter, S. (1960). Alismataceae. In *Fl. Tropical E. Africa* 1960: 1-16. [Includes full illustrations of *Limnophyton obtusifolium*, *L. angolense* and *Caldesia reniformis*.]
- Cook, C. D. K. (1978). Alismataceae. In Heywood, V. H., edit., 'Flowering Plants of the World'. (Mayflower: New York).
- Cook, C. D. K. *et al.* (1974). 'Water Plants of the World'. (W. Junk: The Hague).
- Hartog, C. den (1957). Alismataceae. In *Fl. Malesiana* ser. 1, 5: 317-334. [Includes full illustrations of *Limnophyton obtusifolium* and *Caldesia oligococca*.]
- Hutchinson, J. (1973). 'The Families of Flowering Plants', 3rd edn. (Oxford University Press: London).

- Leach, G. J. and Osborne, P. L. (1985). 'Freshwater Plants of Papua New Guinea'. (University of Papua New Guinea: Port Moresby).
- Lai, M.-J. (1977). A re-evaluation of a *Caldesia* plant in Taiwan. *Taiwania* 22: 100-104. [Includes full illustration of *C. grandis*.]
- Pichon, M. (1946). Sur les Alismatacees et les Butomacees. *Not. Syst.* 12: 170-183.
- Symoens, J. J. (1984). Alismataceae. In *Fl. du Cameroun* 26: 3-26. [Includes full illustrations of *Limnophyton obtusifolium*, *L. fluitans* and *Caldesia reniformis*.]
- Symoens, J. J. and Billiet, F. (1975). Alismataceae. In *Fl. D'Afrique Centrale* 1975: 1-21. [Includes full illustrations of *Limnophyton angolense* and *Caldesia reniformis*.]

Manuscript received 4 June 1986.